

Table 4 Lamellar Formulations

INCI name	wt (%)											
	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL
alkyl polyglucoside sodium	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
lauroamphoacetate	0.0	0.0	0.0	0.0	0.0	5.7	0.0	0.0	0.0	0.0	0.0	0.0
sodium laureth sulfate	5.0	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	11.0	13.0	12.4
Cocoamidopropyl betaine	5.0	5.7	5.7	5.7	5.7	0.0	5.7	5.7	5.7	6.0	5.0	5.7
Cocamide MEA	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.5	2.0	2.3
citric acid	0.0	0.0	0.2	0.2	0.0	0.6	0.0	0.2	0.0	0.0	0.0	0.0
lauric acid	2.7	0.0	2.3	0.0	3.8	2.7	2.3	2.3	2.3	3.3	3.8	3.7
isostearic acid	0.0	5.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
oleic acid	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PEG-30												
dipolyhydroxystearate	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.3	0.0
Guar hydroxypropyl trimonium chloride	0.5	0.6	0.6	0.6	0.2	0.7	0.7	0.2	0.7	0.0	0.0	0.5
polyquaternium-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
polyquaternium-7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
isopropyl palmitate	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.0	1.5	1.5	2.0
sunflower seed oil	16.0	16.0	0.0	7.0	16.0	21.3	21.3	16.0	21.3	16.0	17.0	14.0
petrolatum	5.0	3.7	5.0	0.0	3.7	3.7	3.7	3.7	3.7	5.0	4.0	3.3
lanolin alcohol	0.5	0.5	0.5	0.0	0.5	0.5	0.5	0.5	0.5	0.8	0.0	0.0
dimethicone	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
castor oil	0.0	0.0	0.0	9.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
glycerin	1.0	5.7	1.0	1.0	5.7	5.7	5.7	5.7	5.7	2.0	6.0	1.0
fragrance	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3
dyes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
preservative	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
DI water	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100

All were prepared as follows:

All lipophilic ingredients, lamellar structurants, cocamide MEA, and lamellar stabilizer (if using) were mixed at 150-180°F, setting aside 5-7% of the triglyceride oil or mineral oil. At this point the heating is turned off. This was followed by the addition of the glycerin, then about 1/3 of the remaining water, then the anionic surfactants, the amphoteric/zwitterionics, then the rest of the water. Isopropyl palmitate is added next, followed by the addition of a slurry made of the cationic polymer with the reserved oil. Once the mixture reaches 120°F, the preservatives are added, and once it cools to 100°F, the dyes (if using) and fragrance are added.

Table 5 Isotropic Formulations

INCI Name	wt %																	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S
Sodium Laureth Sulfate	12.5	9.3	13.7	12.5	11.07	12.5	13.7	9.3	12.5	9.3	12.5	12.5	13.7	12.5	10	9.3	12	9.3
Cocamidopropyl betaine	5	2.5	0.8	3	4.43	3	3.3		3	2.5	3	5	3.3	3			4.5	
Sodium Cocoyl Isethionate		5						5		5					5	5		5
Sodium Lauryl Sulfate																	1	
Cocamide-MEA		1.2	0.5	1	1	1	0.5		1	1.2	0.5		0.5	0.5			1	1.2
Cocamide DEA																1.2		
PEG-150 Distearate			0.25	0.5	0.5	0.5			0.5		0.25			0.25				
Potassium Cocoate								2.5							4			
Hydroxypropyltrimonium chloride	0.15		0.2	0.25	0.25	0.25	0.25		0.25		0.2		0.25	0.2				
Hydroxypropyl guar																		
Hydroxypropyltrimonium chloride		0.4						0.4		0.4					0.4	0.4	0.2	0.4
Cocamidopropyl betaine and Glyceryl Monolaurate			6.6													6.6		6.6
Glyceryl Monolaurate		1.5						1.65		1.5					1.65		1	
PEG-120 Methyl Glucose Dioleate	1.32		1		1.32	1	1					1.32						
PEG-120 Methyl Glucose Trioleate				0.75														
PEG-150 Pentaerythrityl tetrastearate											0.5							
Glyceryl Palmate + PEG-7 Glyceryl cocate														2				
Acrylates Copolymer						0.5												
Sodium Cocoyl Glutamate		0.8						0.8		0.8			1		2	0.8		0.8
Stearic Acid																		
Hydrolyzed Wheat Protein			0.23		0.23				0.23		0.23			0.23				
Isopropyl Palmitate	1.5		1.5	1.5	1.5	1.5	1.5		1.5		1.5	1.5	1.5	1.5				
PEG-40 Hydrogenated Castor Oil	0.5		0.5	0.5	0.5	0.5	0.5		0.5		0.5	0.5	0.5	0.5				
Propylene Glycol			0.5					0.5							0.5	0.5	0.5	0.5
Glycerin				0.5	0.5	0.5			0.5					0.5				
Fragrance	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Color	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Preservative	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Citric Acid	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Water	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100	to 100
Viscosity	688	9038	25000+	835	63400	2677	9840	393	344	24460	221	197	0	442	197	47800	77020	25000+
Mix with Heptane?	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES
Viscosity after 6% Heptane addition	7785	123	5108	5157		25000+	25000+	0	147	835	2357	8854	196	418	0	295		712
Process	6	8	9	6	3	7	2	12	1	8	10	4	2	5	12	8	11	8

Table 7 Processes used to formulate isotropic samples in table 5

Process 1	Process 2	Process 3
Add initial water charge and heat to 150F-160F	Add initial water charge and heat to 150F-160F	Add initial water charge and heat to 150F-160F
Premix cationic polymer with glycerin and add to main batch	Add anionic surfactant	Premix cationic polymer with glycerin and add to main batch
Mix 15 minutes	Add amphoteric surfactant	Mix 15 minutes
Add anionic surfactant	Premix cationic polymer with Isopropyl Palmitate and add to main batch	Add anionic surfactant
Add amphoteric surfactant	Mix 15 minutes	Add amphoteric surfactant
Add other ingredients such as PEG-150 Distearate, Cocamide-MEA, Hydrolyzed Wheat Protein, Glycerin, or Isopropyl Palmitate	Add other ingredients such as PEG-150 Distearate, Cocamide-MEA, Hydrolyzed Wheat Protein, Glycerin, or Isopropyl Palmitate	Add other ingredients such as PEG-150 Distearate, Cocamide-MEA, Hydrolyzed Wheat Protein, Glycerin, or Isopropyl Palmitate
Maintain heat and mix for 30 minutes	Add PEG-120 Methyl Glucose Dioleate	Add PEG-120 Methyl Glucose Dioleate
Begin to cool to 95F	Maintain heat and mix for 30 minutes	Maintain heat and mix for 30 minutes
Premix Fragrance, PEG-40 Hydrogenated Castor Oil, and Isopropyl Palmitate and add to main batch at 110F	Begin to cool to 95F	Begin to cool to 95F
Mix for 15 minutes	Premix Fragrance and PEG-40 Hydrogenated Castor Oil and add to main batch at 110F	Premix Fragrance and PEG-40 Hydrogenated Castor Oil and add to main batch at 110F
Add preservatives, color, and promotionals	Add preservatives, color, fragrance and promotionals below 110F	Add preservatives, color, and promotionals below 110F
Add citric acid to adjust pH to a target range of 5.5-6.0	Add citric acid to adjust pH to a target range of 5.5-6.0	Add citric acid to adjust pH to a target range of 5.5-6.0
Mix for 15 minutes and measure final viscosity	Mix for 15 minutes and measure final viscosity	Mix for 15 minutes and measure final viscosity

Process 4	Process 5	Process 6
Add initial water charge and heat to 150F-160F	Add initial water charge and heat to 150F-160F	Add initial water charge and heat to 150F-160F
Add anionic surfactant	Premix cationic polymer with Propylene glycol and add to main batch	Premix cationic polymer with Isopropyl Palmitate and add to main batch
Add amphoteric surfactant	Mix 15 minutes	Mix 15 minutes
Add Isopropyl Palmitate	Add amphoteric surfactant	Add anionic surfactant
Mix 15 minutes	Add anionic surfactant	Add amphoteric surfactant
Add PEG-120 Methyl Glucose Dioleate	Add other ingredients such as PEG-150 Distearate, Cocamide-MEA, Hydrolyzed Wheat Protein, Glycerin, or Isopropyl Palmitate	Add PEG-120 Methyl Glucose Dioleate
Maintain heat and mix for 30 minutes	Add Glyceryl Laurate or other low molecular weight polymer	Maintain heat and mix for 30 minutes
Begin to cool to 95F	Maintain heat and mix for 30 minutes	Begin to cool to 95F
Premix Fragrance and PEG-40 Hydrogenated Castor Oil and add to main batch at 110F	Begin to cool to 95F	Premix Fragrance and PEG-40 Hydrogenated Castor Oil and add to main batch at 110F
Add preservatives, color, and promotionals below 110F	Premix Fragrance and PEG-40 Hydrogenated Castor Oil and add to main batch at 110F	Add preservatives, color, and promotionals below 110F
Add citric acid to adjust pH to a target range of 5.5-6.0	Add preservatives, color, and promotionals below 110F	Add citric acid to adjust pH to a target range of 5.5-6.0
Mix for 15 minutes and measure final viscosity	Add citric acid to adjust pH to a target range of 6.0-6.5	Mix for 15 minutes and measure final viscosity
	Mix for 15 minutes and measure final viscosity	

Process 7	Process 8	Process 9
Add initial water charge and heat to 150F-160F	Add initial water charge and heat to 150F-160F	Add initial water charge and heat to 150F-160F
Add Acrylates Copolymer	Add first anionic surfactant	Premix cationic polymer with Propylene glycol and add to main batch
Add anionic surfactant	Add second anionic surfactant	Mix 15 minutes
Add amphoteric surfactant	Add amphoteric surfactant	Add amphoteric surfactant
Premix cationic polymer with Isopropyl Palmitate and add to main batch	Add cationic polymer	Add low molecular weight polymer
Mix 15 minutes	Add Glyceryl Laurate or other low molecular weight polymer	Add anionic surfactant
Add other ingredients such as PEG-150 Distearate, Glycerin, and Cocamide-MEA	Add Sodium Cocoyl Glutamate	Add other ingredients such as PEG-150 Distearate, Cocamide-MEA, Hydrolyzed Wheat Protein, Glycerin, or Isopropyl Palmitate
Maintain heat and mix for 30 minutes	Add Cocamide-MEA	Add PEG-120 Methyl Glucose Dioleate
Begin to cool to 95F	Begin to cool to 95F	Maintain heat and mix for 30 minutes
Premix Fragrance and PEG-40 Hydrogenated Castor Oil and add to main batch at 110F	Add preservatives, color, fragrance, and promotionals below 110F	Begin to cool to 95F
Add preservatives, color, and promotionals below 110F	Add citric acid to adjust pH to a target of 6.4	Premix Fragrance and PEG-40 Hydrogenated Castor Oil and add to main batch at 110F
Add citric acid to adjust pH to a target range of 5.5-6.0	Mix for 15 minutes and measure final viscosity	Add preservatives, color, and promotionals below 110F
Mix for 15 minutes and measure final viscosity		Add citric acid to adjust pH to a target range of 5.5-6.0
		Mix for 15 minutes and measure final viscosity

Process 10	Process 11	Process 12
Add initial water charge and heat to 150F-160F	Add initial water charge and heat to 150F-160F	Add initial water charge and heat to 150F-160F
Premix cationic polymer with Propylene glycol and add to main batch	Premix cationic polymer with Propylene glycol and add to main batch	Add first anionic surfactant
Mix 15 minutes	Mix 15 minutes	Add second anionic surfactant
Add amphoteric surfactant	Add amphoteric surfactant	Add Potassium Cocoate
Add anionic surfactant	Add anionic surfactant	Premix cationic polymer with Propylene glycol and add to main batch
Add other ingredients such as PEG-150 Distearate, Cocamide-MEA, Hydrolyzed Wheat Protein, Glycerin, Isopropyl Palmitate, or low molecular weight polymer	Add second anionic surfactant	Add low molecular weight polymer
Add long chain PEG	Add other ingredients such as PEG-150 Distearate, Cocamide-MEA, Hydrolyzed Wheat Protein, Glycerin, Isopropyl Palmitate, or low molecular weight polymer	Add Sodium Cocoyl Glutamate
Maintain heat and mix for 30 minutes	Maintain heat and mix for 30 minutes	Begin to cool to 95F
Begin to cool to 95F	Begin to cool to 95F	Add preservatives, color, fragrance, and promotionals below 110F
Premix Fragrance and PEG-40 Hydrogenated Castor Oil and add to main batch at 110F	Add preservatives, color, fragrance, and promotionals below 110F	Add citric acid to adjust pH to a target of 7.3
Add preservatives, color, and promotionals below 110F	Add citric acid to adjust pH to a target range of 6.0-6.5	Mix for 15 minutes and measure final viscosity
Add citric acid to adjust pH to a target range of 6.0-6.5	Mix for 15 minutes and measure final viscosity	
Mix for 15 minutes and measure final viscosity		